HUMERAL NAIL

BACKGROUND OF THE INVENTION

[0001] The invention is related to a bone nail having a plurality of transverse bores at one end thereof. More particularly, it relates to a humeral nail having a plurality of holes being angularly offset, both in a plane perpendicular to the nail axis and at an angle to that plane. It is known that fractures of the humerus often occur in the proximal region, particularly in the head region of the humerus. For the surgical care of such fractures, it is already known to provide a so-called locking nail. Preferably, the nail is driven into the humeral channel from the proximal to the distal direction. The nail is provided with locking bores in the proximal region as well in the distal region, through which bone screws are guided in order to secure the locking nail against axial dislocation and torsion. The bone screws in the proximal region serve also for the fixing of bone fragments.

[0002] A humeral nail of the described type has become known from U.S. Patent No. 5,472,444. This nail is provided with an oblong shaft and has four transverse bores in the proximal region, which bores are disposed axially spaced apart and angularly offset from each other, in the circumferential direction. The nail shaft is also bent.

SUMMARY OF THE INVENTION

[0003] The present invention has as one object to improve a humeral nail of the type described in U.S. Patent No. 5,472,444 to the effect that an even more effective guiding of the nail or the fracture fragments, respectively, can take place.

[0004] In the humeral nail of the present invention, the proximal transverse bore, i.e. that one which is situated closest to the proximal end, has an axis disposed diagonally to the longitudinal axis of the nail shaft.

[0005] In a humeral nail inserted in the proximal direction into the humerus, the nail sits on the outer side of the humerus head, and the transverse bores in the proximal portion are arranged such that the locking screws can be screwed into the humeral head from different directions. In the inventive nail, the diagonal arrangement of the proximal most transverse bore is such that the bone screw is screwed in from the outside towards the inside diagonally downwardly (distally). Through this, the bone screw is arranged in an anatomically more favorable fashion, because by doing so the transmission of force to the nail is configured in a more favorable manner. In addition, the bone screw can obtain a greater length, because it can be put into the humeral head across a greater length. Thus, added together, the surgical care of fractures in the head region of the humerus is improved by the features of the nail of the present invention.

[0006] According to one embodiment of the invention, the inclination of the axis of the proximal most transverse bore with respect to the longitudinal axis of the nail shaft is at an angle of about 80°.

[0007] As already mentioned, several transverse bores are provided in the proximal portion of the nail shaft. According to one embodiment, the axis of the distal most transverse bore in the proximal portion, i.e. that transverse bore which has the greatest distance from the proximal end of the nail shaft, is also disposed diagonally with respect to the longitudinal axis of the nail shaft. The angulation is such that the axis of the proximal and the distal transverse bores converge and diverge, respectively. Preferably, the bores are directed into opposite directions, i.e. one angled upwardly and one downwardly. This measure, too, proves to be extremely advantageous in fractures of the humeral head, because even here the bone screw can be selected to be longer and can be

put into the endangered regions of the humerus head more effectively.

[0008] According to one embodiment of the invention, the angular offset of the distal transverse bore with respect to the proximal transverse bore is approximately 25°, this offset being preferably directed into the direction opposite to the offset of that one transverse bore which follows the proximal transverse bore.

[0009] Preferably, four transverse bores are provided in the proximal portion, the two middle bores preferably running with their axis perpendicular to the longitudinal axis of the nail shaft. The distal most bore in the proximal portion and the adjacent more proximal bore are circumferentially offset by about 90°.

[0010] According to another embodiment of the invention, the nail shaft can be solid rather than cannulated. According to a further embodiment of the invention, the nail has two distal bores one of the two distal transverse bores is constructed as an elongated (oblong) hole oriented parallel to the longitudinal axis in the distal region.

[0011] With a straight shaft, it is necessary that two separate humerus nails be provided for the left and the right humerus. According to one embodiment of the invention, except for the proximal most transverse bores, the remaining transverse bores are provided in a different arrangement for the left and the right nail shaft, the two arrangements being indeed similar with respect to the axial distance and the relative angular position, but being rotated by 180° with respect to the longitudinal axis.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] One example of the invention will be explained in more detail by means of drawings.

[0013] FIG. 1 shows the longitudinal view of a humeral nail for the right humerus in a side view;

[0014] FIG. 2 shows the side view of the nail according to FIG. 1, rotated by 90°;

[0015] FIG. 3 shows a section through the nail according to FIG. 1 along the line 3-3; and

[0016] FIG. 4 shows the side view of an inventive humeral nail for the left humerus in a view analogous to FIG. 2.

DETAILED DESCRIPTION

[0017] Referring to FIGS. 1 to 3, there is shown a preferred humeral nail 10 for the right humerus. It has a straight shaft with a proximal end 12 and a distal end 14. The nail 10 is put into the humerus from the proximal direction and serves for the surgical care of fractures in the proximal region of the humerus (not shown). The nail 10 is constructed as a locking nail having cross-bores for receiving locking screws.

[0018] The nail shaft has a longitudinal axis 15 and has a proximal portion 16, which extends distally to a point 18. In the preferred embodiment, the proximal portion 16 has a constant diameter. Beginning with cross-section 18, which can be preferably formed as a relatively smooth transition, a relatively short conical portion 20 follows, and in turn is followed by a further conical portion 22. From cross-section 24 at the distal end of conical portion 22, the nail shaft extends up to the distal end 14 approximately with the same smaller diameter. The distal end portion 26 being again formed conically or spherically.

[0019] In the preferred embodiment, proximal end 12 is provided with three transverse slits 28 running perpendicular to the longitudinal axis of the nail shaft, which cooperate with corresponding projections in a device (not shown) for aiming and hammering in the nail. Slits 28 allow the nail 10 to be accommodated in the proper angular position by the device.

[0020] In the preferred embodiment, proximal portion 16 has four transverse bores 31, 32, 34 and 36. The axis of the middle bores 32, 34 extend perpendicular to the longitudinal axis of nail 10, but are rotated by 115° with respect to each other. In the preferred embodiment, the axis of proximal transverse bore 30 is disposed diagonally to the longitudinal axis, e.g. at an angle of approximately 80°, i.e. rotated 10° with respect to a plane perpendicular to the longitudinal axis 15. The proximal transverse bore 30 partially intersects an axial bore 40 of nail 10, which serves for the connection with the device (not shown) for insertion and aiming.

[0021] Bore 32 following as the next one to proximal bore 30 is located on the circumference offset with a certain angle of preferably 25°. This offset is easily seen in FIG. 1. The distal transverse bore 36 also runs diagonal to the longitudinal axis of the nail 10 with its axis, e.g. in an angle of 75° (i.e. rotated 15° with respect to a plane perpendicular to longitudinal axis 15) with the axis of transverse bores, 30, 36 converging and diverging, respectively on opposite sides of nail 10. In addition, the axis of distal transverse bore 36 is rotated with respect to proximal transverse bore 30 in the circumferential direction, again at approximately 25°. The rotation with respect to the transverse bore 32 takes place in the opposite direction, however, which again emerges from FIG. 1.

[0022] The transverse bores 30 to 36 serve for the accommodation of bone screws (not shown), which are screwed into the humerus head via the hard outer layer of the humerus. For locating transverse bores 30 to 36, a corresponding aiming device (not shown) is required. The offset in the circumferential direction of the transverse bores with regard to each other enables the arrangement of the bone screws from out different directions, in order to provide surgical care to the corresponding fractures in the humerus head in an optimal

manner. The diagonal arrangement of the transverse bores 30 and 36 enables an even more optimal care of fractures, with better transmission of force from the bone to the nail and reversely. In addition, the diagonal arrangement of transverse bores 30 and 36 enables the use of particularly long bone screws, without which the danger exists that the humerus head might be pushed through. In the preferred embodiment, bores 32 to 36 are provided with a thread, which corresponds to the locking or bone screws. Through this, an unintended drifting out of the screws is prevented.

[0023] In the preferred embodiment, portion 27 of nail 10 has two transverse bores 42, 44 are provided at a relative distance to distal end 14. The axis of the bores lay in one plane in which plane the axis of the proximal transverse bore 30 is also situated. This plane contains longitudinal axis 15 of the shaft. The distally positioned distal transverse bore 44 may be in the form of an elongated hole, which can be recognized particularly from FIGS. 1 and 3. The transverse bores 42, 44 serve for the accommodation of bone screws for the bracing of nail 10 in the humerus shaft.

[0024] As already mentioned, nail 10 according to FIGS. 1 to 3 serves for the surgical care of fractures in the right humerus. A nail 10a for the left of the humerus is represented in FIG. 4 and the shaft is formed identically to the shaft of nail 10 according to the FIGS. 1 to 3. For that reason, the shaft will not be discussed further in detail in connection with nail 10a, except for the proximal portion 16a, which also has four transverse bores 30a, 32a, 34a and 36a. The construction of the transverse bores 30a to 36a again resembles those according to FIGS. 1 to 3. Even the position of the proximal transverse bore 30a is identical to the transverse bore 30 according to FIGS. 1 to 3. Only the arrangement of the transverse bores 32a to 36a is different to that one according to FIGS. 1 to 3, in that this arrangement

is mirror-like with respect to that one according to FIG. 2. The different arrangement at nail 10a results purely from the fact that the nail 10a is used for the left humerus. Thus, with respect to the humerus to be applied, i.e. the left or right one, the arrangement of the transverse bores 30 to 36 and 30a to 36a are identical. The bores 30, 32, 34 and 36 for either the left or right versions may be threaded to correspond to the threads of a locking screw. The nail shaft 10, 10a may either be straight or curved. If the nail is curved, then the angular relationships would be with respect to the longitudinal axis at that part of the shaft, i.e. proximal or distal.

[0025] Although the invention herein has been described with reference to particular embodiments, it is to be understood that these embodiments are merely illustrative of the principles and applications of the present invention. It is therefore to be understood that numerous modifications may be made to the illustrative embodiments and that other arrangements may be devised without departing from the spirit and scope of the present invention as defined by the appended claims.